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**WISCONSIN GREATER PRAIRIE-CHICKEN MANAGEMENT AND RECOVERY
PLAN 2004-2014**

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EXECUTIVE SUMMARY

The Greater Prairie-Chicken (*Tympanuchus cupido pinnatus*) (GPC) is a native grouse species originally found in the southern half of Wisconsin in native prairies and savannas at European settlement. Large-scale logging and subsequent fires in the latter half of the nineteenth century created temporarily open land, and by the beginning of the 20th century, the bird was present in every county.

Agriculture, tree planting, fire control and natural succession all reduced GPC habitat, and by the middle of the twentieth century the population had plummeted and now occurs only in a portion of central Wisconsin. Within the past decade there has been a contraction of occupied range towards four state Core Areas managed specifically for GPC as land use on private lands in the GPC range has shifted to an emphasis on row crops (from grass based agriculture), and wooded cover and home building increased. The species is currently listed as state Threatened.

Wisconsin has a 75-year history of commitment to conserving the GPC resource and its habitat. Early work in the field by Aldo Leopold and Wallace Grange was followed with further research by Fred and Fran Hamerstrom, culminating in the first management plan for the species in the state. This plan revision identifies priorities for committing additional resources to conserving GPC in Wisconsin reflecting recent research recommendations (Prairie chickens & Grasslands: 2000 and Beyond (PCG2B) conducted by John Toepfer et. al and sponsored by the *Society Tympanuchus Cupido Pinnatus*).

PCG2B determined that Wisconsin GPC populations are isolated from one another by physical barriers – lack of suitable habitat. This isolation has caused a decline in genetic variability. Habitat loss, population fragmentation, and reduced genetic variability could lead to the eventual extirpation of the bird from Wisconsin if not addressed. Conserving the Wisconsin GPC population requires immediate establishment of more grassland habitat, continued close population monitoring, and introduction of GPCs from other states.

This plan outlines a goal (Recover, conserve, and enhance a viable population of Greater Prairie-Chickens in Wisconsin.), management objectives, and actions that are critical to conserving GPCs in Wisconsin. Long-term objectives include expanding grassland conservation in the GPC range to a total of 50,260 acres of which approximately 22,300 currently exist. It recommends adding 9,100-15,000 acres of permanent grassland over the next 10 years in a proposed project area of over 310,000 acres (<5% of the total area), and maintaining the agricultural component of the landscape. Conservation easements, purchase of development rights, land trust acquisitions, Farm Bill programs, and fee title acquisition will be cornerstones in the success of this plan. At the end of the 10 year period, accomplishments and impacts (population status) will be reviewed and this plan will be evaluated and revised.

Securing permanent grasslands to compliment and support suitable habitat on private land is the best permanent solution to the objective of maintaining GPCs in Wisconsin. This approach will

also benefit all other grassland obligate species, many currently endangered, threatened or rare, in Central Wisconsin.

The actions in this plan will be implemented through cooperation and coordination of WDNR, federal, and county staff, along with numerous partners. Stewardship fund money will be supported by federal and partner dollars.

RATIONALE

Since the first wildlife research project in Wisconsin (Gross 1930), WDNR has been committed to conserving the Greater Prairie-Chicken (GPC). A diverse set of partners (including, but not limited to, WDNR, Society Tympanuchus Cupido Pinnatus (STCP), Dane County Conservation League, The Prairie Chicken Foundation, University Wisconsin – Stevens Point, Becoming an Outdoors Woman, Wisconsin Society for Ornithology, and many local residents) has successfully fought extirpation of the species and collaterally benefited many other grassland species.

Simplistically, open space and grass are what GPCs require to persist. Previous efforts have consistently recommended that the grasslands currently managed for GPC are not enough (see Hamerstrom et al. 1957, Hamerstrom and Hamerstrom 1973, WDNR 1995, and Toepfer 2003 for a few examples). To maintain the Wisconsin commitment to the GPC, there is no choice but to expand the amount of permanent grassland within the currently occupied GPC and restore genetic diversity.

The landscape within the Wisconsin GPC range, is recognized as one of the state's premier grassland management opportunities. Sample and Mossman (1997) identify the Buena Vista/Leola Grasslands as the model for the concept of large-scale management areas and state that this landscape is the single most important in central Wisconsin for managing and conserving all grassland birds. The Wisconsin Land Legacy Report (WDNR 2002) identified the current GPC range as probably the best location in Wisconsin to create a grassland landscape large enough to sustain viable populations of most grassland species. Expansion of grassland throughout the GPC range is critical for this species and will benefit other grassland obligates such as Grasshopper Sparrow, Upland Sandpiper, Henslow's Sparrow, Eastern Meadowlark, Badgers, and Regal Fritillary Butterflies.

Table 1. Land use comparison of major relevant habitat types in Greater Prairie-Chicken (GPC) range. 1991 compared to 1998 and 2002 data. Numbers are percent of area in each habitat type (after WDNR 1993).

Habitat type	Intensive GPC management				Little or no GPC management			
	Leola Marsh WMA		Buena Vista Marsh WMA		Paul J. Olson WMA		Northern Range	
	1991	1998	1991	1998	1991	1999	1991	2002
Row crop	29	29	31	37	14	17	16	29
Hay	0	0	7	0	28	25	32	20
Grazed land	14	9	18	14	11	6	7	5
Grassland	13	18	25	25	8	14	8	8
Woodland	21	29	8	13	17	25	13	21

The case for expanding GPC management in Wisconsin is clear:

➤ The portion of Wisconsin occupied by GPCs has declined greatly since 1991 (Toepfer 2003) (Fig. 1), coincidental with an increase the proportions in row crop and woodland and a decrease in hay land in the portion of the GPC range without state management (Table 1). (The stippled area in Figure 1. visually depicts range contraction since 1991. It is important to note that not all of the range encompassed by the 1991 or 2001 polygons is *occupied* range. The visual effect of the stippling is meant to demonstrate range contraction, it is not intended to be used for quantitative purposes.)

➤ While the range-wide (WI) number of booming males remains fairly stable (Fig. 2), over 60% of the booming males (Keir 2003) reside on or are closely associated with three GPC Core Areas¹. Paul J. Olson Wildlife Management Area (PO) contains an additional 32% of the booming males. However, there is very limited habitat security at PO and permanent grass is a top priority.

➤ Limited dispersal/movements were documented between the main sub-populations (Halfmann 2002) resulting in population fragmentation and isolation of the fragments. A major research effort supported by STCP concluded in part that heterozygosity (a measure of genetic variation) of Wisconsin GPCs is reduced compared to historical samples (Bellinger et al. 2003, Johnson et al. 2003). Fully 92% of the booming males in the 2003 survey (Keir 2003) were on the 4 state wildlife areas (BVM, LM, PO, Mead). Connecting GPCs on all state managed areas and translocating GPC from other state(s) are top priorities.

➤ The number of booming grounds away from state managed areas (primarily the Northern Range (NR)) dropped by 53% (15 to 7) and the number of booming males there by 75% (134 to 34) between 1991 and 2002. The precipitous decline in the number of booming grounds in the NR is a strong indicator that habitat on private lands that recently supported GPCs is declining rapidly (Hamerstrom and Hamerstrom 1973).

NATIONAL RANGE

The GPC is found in 11 states with estimated populations (1999) ranging from about 200 birds in Illinois and Iowa to nearly 180,000 in Kansas. GPCs are likely most endangered in Illinois and Iowa. Populations appear low but mostly stable in Wisconsin, stable and large enough to support hunting in South Dakota and Nebraska, increasing in Colorado, Minnesota and North Dakota, declining but large enough to support hunting in Kansas, and declining in Missouri and Oklahoma. (See Westemeier and Gough 1999, and Toepfer 2003 for a detailed summary.)

Nearly six decades ago A.W. Schorger, a noted wildlife historian from Wisconsin, had the following comments about the remaining GPC population still present in his state. He stated “A

¹ Core Areas include four wildlife management properties where GPC management is a priority: Buena Vista Marsh (BVM), Leola Marsh (Leola), Paul J. Olson (PO), and George Mead (Mead) Wildlife Management Areas. The three referred to here are BVM, Leola, and Mead.

factor that cannot be overlooked ... our prairie chickens are virtually isolated. Localization of the present small population may render the species incapable of surmounting crises" (Schorger 1944).

The GPC is unique to North America, and over the past 100 years, GPC range nation-wide has contracted dramatically (see Westemeier and Gough 1999, Svedarsky et. al 2000, and Toepfer 2003 for details). Extirpation and increasing population fragmentation and isolation due to habitat loss are common reports in GPC literature and discussions. Many factors have contributed to the loss of suitable grassland habitat, which in turn has resulted range reductions and the creation of isolated populations. The heath hen (*T. c. cupido*) is now extinct, the Attwater's prairie chicken (*T. c. attwateri*) is federally listed as an endangered species in Texas and is perilously close to extinction, and several small populations of the GPC no longer exist (i.e., Arkansas, Kentucky, Ohio, Indiana, Michigan, and the Canadian provinces of Saskatchewan and Alberta,). Even within the areas of "better range," the GPC is experiencing population reduction and fragmentation of grassland habitats.

The habitat base and number of individuals varies considerably among remaining populations, most of which are considered isolated. Issues such as minimum viable population, genetic diversity, translocation and captive rearing are currently being addressed in an attempt to maintain numbers. In addition, grassland habitat management is accomplished on differing scales across the remaining range. The North American Grouse Management Plan is being developed in an effort to raise the profile of the decline in North American grouse and their habitats including the GPC. However, the prospects for long term security remain very uncertain.

WISCONSIN MANAGEMENT HISTORY

Historically, the GPC was found in the southern half of Wisconsin in native prairies and savannas, with the original breeding range extending north to River Falls, east to Green Bay, and south to Milwaukee (Schorger 1944). Large-scale logging and subsequent fires in the latter half of the nineteenth century created temporarily open land, and the range expanded northward. By the beginning of the 20th century, the bird was present in every county (Grange 1948). However, the turn from expanding to declining habitat occurred rapidly and by the middle of the twentieth century the GPC population had plummeted (Robbins 1991). The last GPC hunting season in Wisconsin was in 1955. Properly regulated hunting harvest through permit control is biologically possible, but there is no program in place at this time.

Wisconsin's commitment to the GPC began in 1928 with the first wildlife research project (Gross 1930) conducted by the newly formed Wisconsin Conservation Commission (now the Wisconsin Department of Natural Resources). The Wisconsin Prairie Chicken Investigation, under the direction of Dr. Alfred O. Gross along with work by others such as Aldo Leopold, Franklin J. W. Schmidt, and Wallace Grange, paved the way for the pioneering research conducted by Frederick N. and Frances Hamerstrom. Nearly two decades of investigation culminated in the publication of "A Guide To Prairie Chicken Management" in 1957 by the Hamerstroms and Oswald Mattson. This "Guide" outlined the basics for the management program in Wisconsin.

In central Wisconsin, large-scale agricultural drainage (beginning in 1905 on Buena Vista Wildlife Management Area (BVM) and in 1910 on Mead Wildlife Management Area (Mead)) allowed development of private land use suitable to GPCs – primarily pasture and bluegrass seed industry on BVM, and lowland vegetable cropping and associated upland farming at Mead.

As a result of the Hamerstroms' early work, the private sector (including the Society Tympanuchus Cupido Pinnatus, The Dane County Conservation League, and Wisconsin Society for Ornithology) stepped forward and provided the capital to purchase land for management. These purchases led the establishment of the “grassland reserves” recommended in the “Guide” and helped secure a future for the GPC in Wisconsin. Throughout the 1950's, 1960's and into the 1970's nearly 14,000 acres of land were purchased for grassland management. Acquisition since the 1980's has slowed.

In hindsight, this was a mistake. Acquisition to connect GPC populations should have continued as was recommended (Hamerstrom and Hamerstrom 1973). The Core Areas recommended at that time were BVM, Leola Marsh Wildlife Area (Leola), Mead, and the Paul J. Olson Wildlife Area (PO). Specific GPC management practices implemented on BVM and Leola have proven effective at maintaining GPC populations there. However, the population using the BVM and Leola are disjunct from those on PO and Mead which, in turn, are disjunct from those in the NR. This separation is likely the result of a physical barrier – lack of suitable habitat between these areas.

Management in the early 1960's concentrated on acreage that had been reverting to brush and timber. Bulldozers, chainsaws, rotary mowers and broadleaf herbicides were all used to restore grasslands. By the mid-1960's, fire was also being used to stimulate grass and retard brush invasion. As additional acreage was acquired, the management effort expanded to keep pace. Throughout the late 1960's and early 1970's, a major grassland restoration effort was accomplished largely with bulldozer and herbicide.

In the “Guide to prairie chicken management” (Hamerstrom et al. 1957) a pattern of grassland habitat improvement and maintenance was proposed through rotational disturbance. The program has been fine-tuned since then and has incorporated some new techniques, but the principles outlined in this work still apply. Periodic disturbance of the grassland and sedge meadow acreage and management flexibility are the basic underlying concepts to maintain grasslands.

The next phase of GPC management in Wisconsin is to guarantee the viability of the population in the face of rapidly changing and detrimental land use practices within the GPC range. Future GPC management will require innovative conservation practices through governmental and non-governmental partnerships and new grassland development within the GPC range.

HABITAT BASE

The habitat of **highest** GPC densities in Wisconsin consists of the following specific components for management units as part of a metapopulation:

- a large area (of 18 square miles minimum (Hamerstrom et al. 1957), more is preferred) of open landscape not more than 20% wooded with wooded tracts in small, scattered blocks;
- a core of permanent managed grassland at least 2,000 acres in size for every 10,000 acres of GPC range
- a minimum of 30% of the open lands in permanent grassland, including the core and scattered blocks of grassland at least 80 acres in size.
- scattered blocks of long-term grass cover (e.g. CRP, CREP and pasture) totaling an additional 15-20% of the open landscape;
- tracts of sedge meadow and/or shrub-carr for winter cover; and
- adequate winter food supply.

Landscape scale characteristics affect GPC population dynamics (Niemuth 2000 and 2003a). If the above components were present, 45 - 50% of the open landscape would be either in permanent or long-term grass cover. Periodic disturbance is essential in Wisconsin (through burning, grazing, and/or mowing) to create and maintain grassland and sedge meadow habitat.

In central Wisconsin, the highest densities of GPC occur on BVM where the above habitat prescription has been applied. *Suitable* GPC habitat is more widespread, but still confined to a relatively small area, including portions of Adams, Portage, Wood, Marathon, Clark and Taylor counties (Fig. 1). Notable densities of GPC are found on PO existing on non-secure grassland with a very low proportion of the area managed for GPC. Lower densities of GPC are found throughout the range and specifically around Mead. These populations are centered around existing secure grasslands and sedge meadow habitat on Mead and unsecure smaller grassland patches on private lands.

Core Areas

Of the four Wildlife Areas (WA) with adequate habitat to support GPC, Leola, BVM, and PO (Figure 1) were established specifically to provide grassland habitat for the GPC. Management is focused on placing only a portion (approximately 25%) of the landscape in permanent grassland. (The concept of “ecological patterning” originally developed through the Hamerstrom’s work.) The majority of the property within the boundaries remains in private ownership – preferably in production agriculture. (Mead includes extensive wetland habitats with adjacent upland managed for grassland wildlife species, including the GPC.) The total managed area for GPCs on these properties was approximately 22,300 acres in 2002 (Table 2).

BVM and Leola are located in areas that have a mixture of open, level cropland and pasture. Soils are fairly light and contain extensive areas of peat. The Hamerstrom’s recommended BVM as the logical area to concentrate GPC management (Anderson and Toepfer 1999). The current BVM and Leola management areas were extensive sedge meadow, open tamarack, and tamarack

swamp at the time of European settlement (Zedler 1966, Cochrane and Iltis 2000). These areas were drained and cleared in the early 1900's for agriculture. Major management emphasis is on grassland maintenance, with the control of woody plant succession a continuing effort. Private land uses such as grass-based agriculture contribute to the maintenance of the open aspect of the landscape.

PO, and Mead are located on heavier soils than the BVM/Leola complex. In this area of central Wisconsin, agriculture is not as intensive on private lands, and woody vegetation encroachment takes place more rapidly than on the lighter soils of BVM and Leola. Conversion of cropland to grassland is a high priority management objective on PO and Mead. Shrub carr and sedge meadow communities account for a significant portion of the private and public landscape in the vicinity of Mead and GPCs depend on them for habitat. Mead has been managed for prairie chickens since its conception, with increased emphasis in the late 80's and 90's. Prescribed burning, mowing, herbicide treatment, and forest removal have all been part of a program to secure needed sedge meadow and upland grassland habitat. In recent years, tree and hedgerow removal have been a priority. Corridors connecting areas of suitable prairie chicken habitat on Mead have also been a priority. Since 1986, 896 acres of agricultural land have been converted to warm and cool season grasses. Only key areas are cropped today (406 acres) to provide fall food for migrating waterfowl and winter food for prairie chickens.

Northern Range

The NR (a.k.a. the Marshfield-Medford Area of Interest or peripheral range) (Fig. 1) is an area with low GPC densities northwest of Mead that contains no publicly managed grasslands. Shrub-carr is well distributed across the landscape, but there is a general lack of grassland nesting cover. Niemuth (2003b) found that the amount of grassland strongly influences GPC numbers and the amount of grassland in the NR was less than that in the managed Core Area of BVM. He also concluded that the habitat in the NR was more fragmented than that in BVM.

Other Sites

The Dewey Marsh Wildlife Area consists of primarily wetland which is comprised of both marsh and bog. The surrounding upland is dominated by aspen with areas of oak and pine. In the fall of 1976, an extensive wildfire burned approximately 4,500 acres with succession in the uplands occurring rapidly after the fire. GPC are present on the wildlife area in very limited numbers. They appear to be present only because of the large open wetland/sedge meadow area.

The McMillan Marsh Wildlife Area currently provides primarily winter habitat for GPCs that use private land to the north and east of Marshfield during other seasons. Many upland areas of the property were farmed in 1984, but by 1993 all cropping had ceased on the property and fields converted to grass. Soils on McMillan are also very heavy and woody encroachment into open fields is rapid.

GENETICS

Low genetic diversity in Wisconsin GPC relative to other populations was been documented by

Bellinger et al. (2003) as part of PCG2B and is a symptom of the major challenge in managing GPC in Wisconsin. Niemuth (2000) quantified the importance of proximity of populations to other GPCs and concluded that proximity is important to reduce declines in fitness due to loss of genetic diversity and to enhance metapopulations. Introducing GPC from outside Wisconsin to restore heterozygosity is a necessary step as is reestablishing connection between GPC populations in Wisconsin to create a single population without restrictions to gene flow.

A recent nationwide comparison of GPC genetics indicates that historically, the range of the species was contiguous and interconnected as one large metapopulation (Johnson et al. 2003). The Wisconsin GPC population went through bottleneck (reduced population size) (Bellinger et al. 2003) and the lowest number of booming males was observed on BVM in 1969. With increased habitat fragmentation since then, the exchange of genetic material has been reduced. A historical comparison between the genetics of GPC collected on the BVM in 1951 with blood from birds caught 1997-2000 indicated that there has been a 26% reduction in microsatellite DNA allelic composition since 1951 (Bellinger et al. 2003). In addition, a comparable reduction in allelic composition has occurred in the remaining three management areas (Mead, PO, and Leola) (Johnson et al. – in prep.). When compared to other contemporary populations throughout their current range, genetic diversity is significantly lower in Wisconsin (Johnson et al. 2001, Johnson et al. 2003).

The majority of GPCs in Wisconsin are currently found on four management areas that are 3 to 12 km apart. Despite this close proximity, genetic analyses indicate that there is significant genetic subdivision among the four contemporary management areas (Johnson et al. 2003). In contrast, there was no genetic subdivision in the same four areas 50 years ago (Johnson et al. 2003.). These results suggest that further habitat fragmentation and isolation of GPC populations within a relatively small area has helped reduce contemporary levels of genetic variability by decreasing the number of individual birds breeding in the total population and stimulating the effects of genetic drift (Templeton et al. 2001, Frankham et al. 2002) within existing management areas. Consequently concerns that the population may have lost – or could lose in the future – genes related to fitness (Wright 1969, Lande 1998, Reed and Frankham 2003) must be addressed.

The re-establishment of genetic interchange between extant sub-populations in Wisconsin is critical. One way to achieve this interchange is to increase the amount of suitable grassland habitat in-between the sub-populations. It is further recommended that management practices be implemented within the existing management areas that will increase GPC numbers and density to the point where birds will likely disperse into both areas inhabited by nearby sub-populations and newly acquired/protected habitat. Finally, monitoring of surrogates for genetic fitness (Reed and Frankham 2003) is necessary to warn of a decline in fitness (i.e. reproductive or survival rates). Any evidence of declining fitness may indicate that the population is experiencing inbreeding depression and genetic introgression (i.e., translocations from outside Wisconsin) is under development.

An approach for translocating GPCs from other states is one of the top priorities of this plan.

Results of previous translocations will be monitored carefully to amass the necessary groundwork required if/when translocations are initiated. Several states (For example: Illinois, Colorado, North Dakota, Iowa, Missouri, Minnesota, and Texas) where translocations have occurred continue to have GPC populations. Collaborations with biologists and researchers there will be invaluable to success in Wisconsin.

REVIEW OF 1995 GPC MANAGEMENT PLAN

The 1995 GPC management plan identified six 10-year objectives, 51 accompanying strategies, and 17 data and research needs. Strategies were intended to direct work activities toward accomplishing the six major objectives. Accomplishments toward these objectives include:

- The first objective (maintain a 1000 bird minimum population) has been achieved. But as suitable range continues to decline due to land use changes, future objectives could be better defined as the number and distribution of active booming grounds and males.
- Currently, 22,300 acres are managed as grassland within the core prairie chicken properties short of the objective of 26,000 in the 1995 plan. Budgetary restrictions and barriers to acquisition have limited the expansion of GPC management. This objective focused on fulfilling the necessary habitat requirements on several traditional Core Areas. Acquisition was completed on nearly 2,000 acres in the past 8 years, but the target of developing 5,000 new acres of grassland on the 4 listed core properties was not accomplished. Most notably only 200 of the goal 1,500 acres on the PO were acquired.
- Additional grassland is under development, mostly off of the Core Areas in Clark, Marathon, Portage, Taylor, and Wood Counties as a result of implementation of the Conservation Reserve Enhancement Program (CREP), Grassland Reserve Program (GRP), tree removal and other Federal Farm Bill programs.
- The 1995 recommendation was for an additional 2,300 acres on private lands adjacent to Mead through a Habitat Restoration Area being implemented (it was not done). This well thought out and visionary approach to secure the chicken, from PO to the outlying areas, was not seen as a Department priority, by the Bureau of Wildlife Management, at that time. In 1993, area biologists voiced major concerns in regards to population trends in the Mead to Unity / Colby sector of the range, but again no action was taken.
- A Core Area of 6,000 acres in the Unity area was recommended in 1995 as well as having been recommended in the 1990 HRA proposal. No action was taken on establishing an acquisition project there.
- The timing and effectiveness of management techniques are being evaluated and improved constantly as more is learned. The incidental take provisions of the endangered resources administrative code were developed to allow proper habitat management while protecting the population.
- At least two GPC transplant proposals have been evaluated since 1995. Neither was approved for implementation at that time although both had very positive qualities and may be reviewed in the future.
- There has been a management shift on Mead to establish more grassland and re-evaluation of other publicly owned properties in the GPC range is necessary. Over 900 acres on Mead have

been converted from cropland to grassland.

- Research projects supported by a wide range of cooperators and partners, particularly STCP have addressed several of the listed research needs in the 1995 GPC Plan. Some of those reports include: Golner (1997), Keenlance (1998), Niemuth (2000), Bellinger (2001), Halfmann (2002), Bellinger et al. (2003), Johnson et al. (2003), Niemuth (2003a), Niemuth (2003b), Toepfer (2003).

ANALYSIS

Greater Prairie-Chickens - The GPC probably would have been extirpated from Wisconsin had not considerable effort been expended to identify their habitat needs and acquire and manage lands to supply this habitat. Their continued existence is a tribute to the insights, actions, and partnerships of the DNR, Society Tympanuchus Cupido Pinnatus, Wisconsin Society for Ornithology, Dane County Conservation League, and many others.

The BVM-Leola complex has been under consistent management for about three decades and the population has remained quite stable there. On PO, there has been a large increase in survey effort since the mid-1990s and while this resulted in the location of many new booming grounds on the mainly private landscape the booming grounds associated with Mead (mainly south of the property) have declined precipitously in the time of survey. On the NR, the decline has been the greatest. Seventy booming males were recorded in the NR in 1991. In no survey year since have more than 60 males been recorded.

A mean of 600 breeding cocks (rangewide) was found during 1994-2003 (Anderson and Toepfer 1999, Keir 2003). Regression analysis of the number of cocks counted each spring (fig 2.) indicates no trend on the BVM-Leola complex (1950 – 2003; $r^2 = 0.06$, $F = 0.19$, $p = 0.66$); a slight increase in birds on the PO-Mead booming grounds (1969 – 2003; $r^2 = 0.106$, $F = 4.74$, $p = 0.04$), and no trend on the McMillan-Northern range booming grounds (1989 – 2003; $r^2 = 0.06$, $F = 1.24$, $p = 0.28$).

Regression analysis of a 10-year rolling average (1969-2003) (applied to mitigate the effects of widely fluctuating populations) shows a significant decline ($r^2 = 0.18$, $F = 5.38$, $p = 0.03$) in the past 30 years of GPC populations statewide. However, on the two Core Areas intensively managed for GPCs (BVM and Leola), there has been a slight increase in the population since surveys began in the 1950's (10-yr rolling average, $r^2 = 0.13$, $F = 6.6$, $p = 0.01$).

Declining population trends in the unmanaged areas, physically isolated population fragments, current land use trends, and decline in heterozygosity clearly dictate that conserving the Wisconsin GPC population requires a two-pronged approach: 1) Immediate, aggressive, and expanded grassland habitat conservation. The number, distribution, and connectedness of booming grounds throughout the range is critical to the long-term viability of the population. 2) A protocol for bringing GPCs from other states to Wisconsin to restore genetic diversity.

The Habitat – Grass suitable for nesting is key to GPC ecology (Hamerstrom and Hamerstrom 1973). Grasslands have declined precipitously across Wisconsin (Sample and Mossman 1997) as has the GPC population. Merrill et al. (1999) found that smaller patches of forest, larger patches of grassland, and an irregular shape of both grassland and forest were beneficial to GPC management. They concluded that enlarging grasslands around traditional leks (booming grounds) and improving the quality of those grasslands were the most important actions for GPC managers. Walk and Warner (1999) found that the size of a grassland is important to its usefulness to GPC. Niemuth (2003b) found that the number of patches in the NR in Wisconsin were greater, and the size of the grasslands around those booming grounds was smaller compared to those on BVM.

The average number of booming grounds on BVM Wildlife Area was 31 and 26 in the 1980s and 1990s, respectively (Jim Keir pers. comm.). Based on an average of 30 booming grounds on BVM and the amount of land in public ownership or management, Toepfer (2003) calculated that 425 acres of permanent grass existed for each booming ground. We applied this rule of thumb in our recommendations for developing and maintaining GPC habitat surrounding existing booming grounds.

BVM and Leola contain 60% of the grassland publicly owned in the GPC range and have 55% of the booming males and 45 – 50% of the total booming grounds. Management on BVM and Leola is intensive (Toepfer 2003) and directed specifically toward grasslands and GPC habitat. This management works, but these areas alone do not appear to be enough to maintain GPCs in Wisconsin.

The Future - Private land use will govern the size and extent of needed public grassland management to conserve the GPC in Wisconsin (Hamerstrom et al. 1957). Land use practices on private lands continue to change for the worse for the GPC. Widespread private land once suitable to GPCs has been converted to incompatible uses. Center pivot irrigation has resulted in conversion of grassland to cropland, and many former large pastures are now planted to potatoes, corn, beans and trees.

Rural development is expanding every year and threatens to permanently isolate publicly owned GPC management cores. Rapid woody encroachment of idle fields areas, maturation of hedgerows and tree lines, tree planting and residential development have contributed to rapid habitat loss. Additional grassland conservation and management through easements, purchase of development rights, land trust conservation, and fee title acquisition with public money is essential. Farm Bill Conservation programs such as the Conservation Reserve Enhancement Program (CREP), are valuable compliments to fee title or conservation easement acquisition.

The GPC range received very high rankings in both recreational and conservation value in the Land Legacy Report (WDNR 2002). “Due to the size, quality and distribution of the existing grasslands” it is ranked in the top five areas for grassland bird conservation in the state (Sample and Mossman 1997). The Nature Conservancy's "Prairie-Forest Border Ecoregion: A conservation plan" (2001) set a conservation goal for all limited distribution G1-G3 species of 10

populations(including GPC), distributed across former range. The BVM-PO-Mead complex was the only area that was identified as still supporting individuals within the entire ecoregion, which extends into northern Illinois, Northeast Iowa, and Minnesota. The GPC is also a Partners In Flight priority bird species (Knutson et al. 2001) and will function well as an umbrella species for grassland management (Poiani et al. 2001).

The state's largest populations of GPC, Henslow's sparrow, and regal fritillary butterflies are found in GPC range. Other declining or rare grassland birds, including grasshopper sparrow, upland sandpiper, eastern meadowlark, northern harrier, and short-eared owl are found locally. Working with farmers and non-farming landowners to create links between scattered grassland parcels will be important in ensuring the long-term viability of populations of grassland dependent species in Wisconsin.

IMPLEMENTATION

Securing the GPC population in Wisconsin requires three things: 1) The development of a large interconnected range of *suitable* habitat; 2) Restoring genetic heterozygosity; and 3) Retaining agriculture as a predominant characteristic of the landscape. All are the top priorities of this plan. The objective is the conservation and management of the fragmented sub populations of GPC as a single population. A large population distributed (with genetic interchange) over an area large enough to ensure security from catastrophe can and will be capable of maintaining heterozygosity..

This plan applies the concept of a scatter-pattern of grassland reserves (or ecological patterning) as described in Hamerstrom et. al (1957) fitted to the existing conditions and recent distribution of GPC on the landscape. Within three current Core Areas (Fig 1.), agriculture must be maintained as a primary component of the non-grassland landscape over residential development or succession to wooded cover. Parcels of grassland of 80 acres or greater should be located in close proximity to active booming grounds and to one another. Random placement of parcels of grassland in the core areas will not produce the benefit necessary for GPC. Careful planning of grassland reserves through expert biologist opinion and coordination with local units of government, partners, stakeholders, and residents will result in the greatest possible benefit to GPC.

Total permanent grassland habitat in the Core Areas will approach 25% of the landscape – much of it in the form of conservation easements remaining in private ownership. Grassland development and conservation on two (BVM and Leola) of the three Core Areas established for GPC is nearly complete – only minor modifications (such as acquisition of critical parcels or divestment in unnecessary parcels) will be needed. Core Area grassland development will focus on the Paul Olson Core Area where less than 1500 acres are currently in secure permanent habitat.

Between the Core Areas, smaller, intervening grassland reserves that support “stepping stone” complexes of booming grounds called connectors will be established. Within identified

connectors (Fig 1), agriculture must be maintained as a primary component of the non-grassland landscape as well. Strategically located parcels of grassland of 80 acres or greater should be conserved in close proximity to active booming grounds and to one another if possible. The proposed connectors will *not* consist of a narrow window of suitable habitat meant to serve as a movement corridor. They will consist of strategically placed pockets of grassland on a suitable landscape. “Stepping stone” booming ground areas will be supported by these miniature grassland reserves located in suitably open space between Core Areas. These will be developed at intervals over which GPC can be expected to travel (from Halfmann 2002) between Core Areas.

In the short-term, we believe that connectivity and population viability are best achieved by establishing 9,100 – 15,000 acres of new permanent grassland (Table 2), developing and implementing an approach to restoring heterozygosity, and continuing population monitoring to measure response. This acreage will provide additional security to high density GPC populations, secure grassland around extant NR booming grounds, and establish complexes of booming grounds between these populations (the most important being between BVM and PO). Actual acres conserved will depend heavily on the level of agency Stewardship Funds available and partner participation, available land, and cooperation and support of local residents. The proposed figure (9,100 – 15,000 acres) amounts to less than 5% of the total land base in the proposed project areas (Table 2) and must be strategically located and supported by an open landscape – primarily agriculture. This acreage figure may evolve after public input and feasibility studies are completed and may need modification as the project is carried out.

The 10-year goals (Table 2) were determined by analyzing recommendations in the best professional judgment of experts, work load impacts (assuming no additional FTE time), sociological factors present on the landscape, and real estate sales data in the area. The goals reflect what experts developing this plan considered biologically necessary, economically feasible, and reasonable benchmarks. This proposal promotes conservation easements that may incorporate agricultural options, and utilizes partners and federal Farm Bill programs to help secure the grassland, both significant factors that will influence the success of this effort. Finally, the location of grasslands secured will be identified in the judgment of experts to provide the greatest benefits to the GPC (i.e. grasslands around booming grounds and those that serve to encourage population connectedness).

Over the long-term (beyond 2014), Toepfer's (2003) minimum target of 30,000 additional grassland acres may be necessary and this recommendation is strongly reflected in the 50,260 acres identified in this plan (Table 2.). Any discussion of acreage goals, however, must be based on what is needed to support a viable GPC population. Proposed acreage goals are best supported by a detailed Population Viability Analysis. Such a model is under development and will help focus the number of acres needed to support a viable GPC population.

What this plan proposes is not new. The recommendations of this plan address the largest threats facing GPC viability in Wisconsin today: habitat loss, habitat fragmentation, population isolation, and genetic viability. Previous and current management has been successful only to the

extent that it has been applied and we must expand now. Success will be heavily dependent on all stakeholders in developing strong buy-in and partnerships.

PROGRAM GOAL

Recover, conserve, and enhance a viable population of Greater Prairie-Chickens in Wisconsin.

TEN YEAR GOALS

- Restore, monitor, and maintain heterozygosity.
- Re-connect Core Areas (BVM/ Leola – PO – Mead) and secure an additional 9,100 – 15,000 acres of permanent grassland throughout the occupied range (Table 2 and Fig. 1).
- Increase and improve GPC population and habitat (grassland and open space) to support approximately 90 booming grounds.
- Maintain predominantly agricultural use of GPC range.
- Continue management on current Core Areas.
- Establish and grow partnerships for prairie chickens and obtain conservation commitments from partners.
- Raise public awareness of grasslands and GPC conservation.
- Evaluate potential sites for selection as GPC translocation areas.
- Develop, identify and define GPC population recovery parameters.

STRATEGIES

- 1) Grassland conservation objectives established by this plan will be established with the following parameters. **(Goals addressed: 1,2)**
 - a) Parcels will be 80 acres or greater (unless they are critical in location or as habitat) in a scatter pattern on the landscape that will enhance booming ground establishment.
 - b) First priority will be permanent grassland conservation of parcels within one mile of active or historic booming grounds that are currently in grassland within the NR, PO, and connector project boundaries.
 - c) Second priority will be permanent grassland conservation of parcels within one mile of active or historic booming grounds (Fig. 1) that are currently in agriculture or other non-wooded use within the NR, PO, and connector project boundaries.
 - d) Third priority will be to acquire permanent conservation rights to strategically located parcels (by local wildlife biologists in cooperation with partners) currently in grass within the project boundaries.
 - e) Fourth priority will be all other strategically located parcels (by local wildlife biologists in cooperation with partners) of non-wooded land within the project boundaries.
 - f) Fifth priority will be wooded lands targeted for conversion to open within the project boundaries.

- 2) Available parcels will be identified and evaluated by local wildlife management personnel and partners. **(Goals addressed: 1,2,5,6)**
 - a) Staff will involve citizens, partners, and local units of government within the area to offer various programs for conservation benefiting the GPC, and will maintain a presence on the landscape.
 - b) Partner groups and organizations will be critical in persuading residents and in partially funding acquisition and habitat management.
- 3) Habitat establishment will be accomplished by developing a GPC project coordinator on site to implement the grassland establishment objectives of this plan. **(Goals addressed: 1,2,5,9)**
 - a) Grassland will be established by offering a suite of programs including flexible and individually tailored options such as conservation easements, agricultural options, fee title acquisition, Fish and Wildlife SEG, and partnership Stewardship Fund grants.
 - b) The project coordinator will be responsible for identifying parcels within the project boundaries and as prioritized above, contacting and coordinating with local and county units of government, contacting landowners, coordinating appraisals, negotiating the details of conservation easements or purchase price, and referring parcels to WDNR for completion through Stewardship funds and/or partner contributions and Grants-in-aid programs.
- 4) An authorization of 15,000 acres (Table 2) of acquisition and conservation easement authority is needed. **(Goals addressed: 1,2,3,9)**
 - a) Stewardship funding, federal farm bill dollars, Fish and Wildlife SEG, and partners will be source funds to develop grassland.
 - b) Fee title acquisition will be a substantial part of this conservation goal – particularly for top priority parcels. However a flexible conservation easement program (described above) that includes maintaining agriculture on the landscape will be a primary tool.
- 5) Develop and implement an approach for translocating GPCs from other states. (WDNR Prairie Grouse Committee, partners, biologists and partners in other states) **(Goals addressed: 4,5)**
- 6) Retain management practices on current Core Areas at current levels and evaluate the management plans and objectives of those publicly owned properties within the GPC range to focus objectives and effectiveness toward GPC habitat. **(Goals addressed: 2,3,6)**

- a) Wildlife management staff responsible for BVM, Leola, Mead, McMillan, and PO will continue to manage, improve, and increase habitat there for GPC.
 - b) Cooperative and unique funding sources will be sought.
 - c) GPC management parallels with waterfowl and turkey management will be investigated in an effort to combine funding efforts and impacts.
 - d) Management practices will be adapted to best serve the GPC population in response to data driven research recommendations.
 - e) Continued development of open space and raptor perch management (tree removal), as well as proper grassland restoration, development, and management (i.e. non-disturbance, burning, grazing, and mowing) will be key components.
- 7) Annual GPC surveys will be continued following the long-term protocol. **(Goals addressed: 3,5,6,8)**
- 8) GPC translocation projects will be evaluated by the Wisconsin DNR Prairie Grouse Committee. **(Goals addressed: 5,6,7,8)**
- 9) Available farm bill programs will be implemented (i.e WHIP, CRP, EQIP, GRP) to best benefit GPC in Wisconsin. **(Goals addressed: 1,2,6,9)**
- 10) The periodic updating of the database of booming ground locations, land use practices, and management operations will continue. **(Goals addressed: 3,6,8)**
- 11) Continue to prevent pheasant restoration or establishment in the primary GPC range. Work with private clubs and individuals to prevent bird hunting preserves and accidental prairie chicken harvest. **(Goals addressed: 5,6)**

ADMINISTRATIVE ACTIONS

- 1) Complete the feasibility study required for the actions outlined within as soon as possible after NRB approval. (Local DNR staff) **(Goals addressed: 1,2)**
- 2) Develop a Minimum Population Viability Analysis. (WDNR Prairie Grouse Committee, Research/ISS, partners) **(Goals addressed: 4,8)**
- 3) Establish recovery parameters for consideration of downlisting the GPC from Threatened to Protected. (WDNR Prairie Grouse Committee, partners) **(Goal addressed: 8)**
- 4) Re-evaluate and adjust master plans and property management plans for Mead, Dewey Marsh Wildlife Area ,and Greenwood Wildlife Area as well as fisheries properties managed by Wildlife Management to better address GPC habitat requirements. **(Goals addressed: 1,2,3)**
- 5) Report annually to the Natural Resources Board and all cooperators and partners detailing progress towards these actions; amend objectives and strategies (if necessary) to reflect changes, progress, and barriers to implementation (Upland Wildlife Ecologist). **(Goal addressed: 6)**

- 6) Communicate with the Division of Forestry to coordinate cross programmatic cooperation in the GPC range. (Upland Wildlife Ecologist) **(Goals addressed: 5,6)**
- 7) Ten years post initiation of this plan, the WDNR Prairie Grouse Advisory Committee will prepare an assessment of implementation success and report to the Natural Resources Board.
- 8) Prevent captive pheasant bird hunting preserves through statute and/or rule changes. **(Goals addressed: 5,6)**

Table 2. Greater Prairie-Chicken (GPC) management areas (existing and proposed), size of current and proposed boundaries, current grassland (acres in 2002), grassland acreage goals both long-term and 10-years post plan implementation, and booming ground goals 10-years post plan implementation.

Property	Area within proposed boundary (acres)	Long-term objectives ^a	Current grassland (acres)	Needed to meet long-term objectives	10-year goals ^b	Booming ground goals
Buena Vista Grasslands	46,700	12,800	11,800	1,000	750-1,000	30
Leola Marsh Grasslands	10,300	2,360	1,860	500	250-500	10
Paul J. Olson Wildlife Area (PO)	45,000	9,800 ^c	1,350	8,450	2,500-3,500	25
George Mead Wildlife Area (Mead)	30,000		7,300 (grass and sedge)	Separate project goals in place		8
BVM – PO Connection	35,000	2,500		2,500	1,000-2,000	4
PO – Mead Connection	65,000	5,000		5,000	1,600-2,500	4
Mead – Northern Range (NR) Connection	35,000	1,500		1,500	1,000-1,500	3
Northern Range	44,200 ^c	9000 ^c		9,000	2,000-4,000	7
Totals	311,200	50,260	22,310	27,950	9,100-15,000	91

^a Long-term goal for permanent grassland conservation (through state, federal, and partner programs) in the identified areas with the GPC range.

^b These figures represent the authorization request for additional permanent grassland in this plan and may be adjusted post feasibility study and may require additional adjustment as the project evolves. Grassland conservation will be accomplished through a flexible program consisting of, but not limited to, fee title acquisition, conservation easements, and purchase of development rights.

^c After Toepfer 2003. The acreage figure represents a one-mile radius circle drawn around 22 booming grounds active in 1989. Currently (2003), four booming grounds exist in this area.

LIST OF FIGURES

Figure 1. Approximate range of the Greater Prairie-Chicken (GPC) in Wisconsin ca. 1990 (after WDNR 1993) and the portion of that range no longer occupied in 2001.

Figure 2. Greater Prairie-Chicken population survey data - Wisconsin, 1950-2003.

Figure 3. Greater Prairie-Chicken booming grounds (2001) and proposed management boundaries for expanding Paul J. Olson (PO), connecting PO and Buena Vista Marsh (BVM), connecting BVM and Leola Marsh (Leola), and connecting PO and George Mead Wildlife Area (Mead).

Figure 4. Northern Range (NR) Greater Prairie-Chicken booming grounds (2001) and proposed area connecting George Mead Wildlife Area (Mead) with the NR.

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